

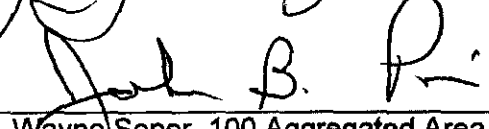
084033


**Meeting Minutes Transmittal/Approval**  
**Unit Managers' Meeting**  
**100 Area Remedial Action and Waste Disposal Unit/Source Operable Unit**  
**3350 George Washington Way, Richland, Washington**  
**August 2000**

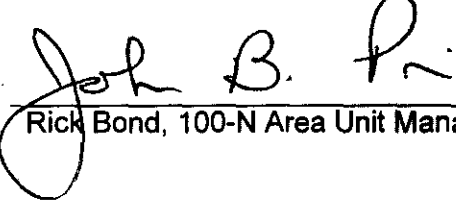
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APPROVAL:  Date 10/17/00  
Glenn Goldberg/Chris Smith, 100 Area Unit Managers, RL (H0-12)

APPROVAL:  Date 11-16-00  
Wayne Soper, 100 Aggregated Area Unit Manager, Ecology (B5-18)

APPROVAL:  Date 10-29-00  
Dennis Faulk, 100 Aggregate Area Unit Manager, EPA (B5-01)

APPROVAL:  Date 11-16-00  
Rick Bond, 100-N Area Unit Manager, Ecology (H0-18)

**RECEIVED**  
DEC 05 2000  
**EDMC**

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Meeting minutes are attached. Minutes are comprised of the following:

Attachment 1	--	Attendance Record
Attachment 2	--	Agenda
Attachment 3	--	100 Area Meeting Minutes
Attachment 4	--	Approved CVPs
Attachment 5	--	100 Area Cleanup Verification Application of the MTCA 3-Part Test to Deep Zone
Attachment 6	--	100 Area Cleanup Verification Evaluation of More Restrictive Total Chromium Groundwater Protection RAG
Attachment 7	--	Backfill Concurrence Checklist - 100-D-12

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Prepared by:

  
Tamen Rodriguez (H0-17)

Date

10/18/00

Concurrence by:

  
Vern Dronen, Project Manager

Date

10/16/00

BHI Remedial Action and Waste Disposal Project (H0-17)

Attachment 1

**Please print clearly and use black ink**

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# UNIT MANAGERS MEETING AGENDA

3350 George Washington Way, Room 1B45

August 24, 2000

**1:00 – 3:00 p.m. 100 Area 1B45**

## **General**

- 100 Area Cleanup Verification Packages
  - Transition of CVP Team Lead
  - General Status
  - Technical Items
- 100 Area SAP/RDR
- Burial Ground ROD Status
- 5 Year Review Status – Comments to Draft
- Status of ERC Comments on EPA 5 – Year Review Draft Document

## **100 H, F and K, Group 4**

- General Discussion/Status

## **100N**

- “Contained in” Determination
- Revisions to 100-N Area SAP
- Revision to RCRA Permit Due to Deferral of Pipelines Around the “Golfball”
- 116-N-1 Air Monitoring Plan Status

## **100-B/C and D**

- General
- Cr(VI) Results from Orphan Sites
- Setup Air Monitor Shut Down Tour at 100-D
- 100-BC Pipelines Procurement Status
- Tri-Party Agreement Milestone Negotiation, Involving 100-BC Pipelines
- CR(VI) Status at 100-D
- Cleanup Verification Status at 100-D

## **Groundwater**

- 100-HR-3, 100-KR-4, and 100-NR-2 Pump and Treat System Status
- ISRM Status
- ISRM Sodium Dithionite Spill
- 100-KR-4 Discharge of Chromium Contaminated Groundwater

084033

# UNIT MANAGERS MEETING AGENDA

3350 George Washington Way, Room 1B45

August 24, 2000

Meeting Attendance Sheet – Attachment 1

Meeting Agenda – Attachment 2

Meeting Minutes – Attachment 3

**1:00 – 3:00 p.m. 100 Area 1B45**

## General

- 100 Area Cleanup Verification Packages

- Transition of the CVP Team Lead – ERC CVP Lead Ralph Wilson introduced the new CVP Team Lead, Alex Nazarali. Ralph and Alex will have a transition period for the next few weeks.
- General Status – ERC (Ralph Wilson) provided attendees with a handout showing general status of the CVP package activities. Ralph briefly discussed the status tables of CVPs in progress and completed (Attachment 4). Ecology (Wayne Soper) stated that ongoing CVP reviews are generally satisfactory, with Ecology mainly having comments regarding language and constituents of concern (COCs) inconsistencies between CVP packages. Ralph also asked both Ecology and attendees for any comments that could assist in streamlining the CVP documents.
- Technical Items – ERC (Ralph Wilson) discussed two technical items related to CVP packages. The first item outlined ERC's conclusions after applying the Model Toxic Control Act (MTCA) 3-Part Test to the deep zone of waste sites (Attachment 5). Ralph explained that CVP packages issued prior to the 116-D-7 CVP contained information from which MTCA 3-Part Test was only applied to the sites' shallow zones. Ecology requested that this test be applied to the deep zone during the preparation of the 116-D-7 CVP and in all subsequent packages. ERC also performed an evaluation of the MTCA 3-Part Test application to previously issued packages, and documented the results in a calculation brief. ERC concluded that CVP packages previous to 116-D-7 passed the MTCA 3-Part Test application, and these sites had also had RESRAD modeling performed to demonstrate protectiveness of groundwater and the Columbia River. Attachment 5 provides the summary of this information for the administrative record.

The second item addressed ERC's evaluation of a more restrictive total chromium standard to Groundwater protection Remedial Action Goal (Attachment 6). ERC had until recently used the MTCA Level B total chromium standard; however, the Washington Administrative Code contains a more restrictive standard. Therefore, ERC evaluated past CVPs for compliance against the more restrictive standard. ERC identified three cases in which the sites did not meet the more restrictive standard, and in the three cases performed RESRAD modeling to demonstrative Groundwater protectiveness. The results were documented in a calculation brief. ERC concluded that all 100 Area sites where total chromium was a COC complied with the more restrictive standard. Attachment 6 provides the summary of this information for the administrative record.

- Status of 100 Area SAP and RDR/RAWP documents, Revision 2 Comment Response/Resolution – ERC (John April) is adding two additional waste sites to the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* ((DOE/RL-96-17, Rev. 1) (RDR/RAWP) and *100 Area Sampling and Analysis Plan* (DOE/RL-96-22, Rev. 1) (SAP). Therefore, transmittal of the revised documents to EPA and Ecology will be delayed. ERC (Kelly Cook) explained that other document changes included incorporating comments and properly addressing the standard for chromium. EPA (Dennis Faulk) asked if ERC could change CVP documents that are impacted by the RDR/RAWP and SAP changes. ERC (Mark Sturges) proposed that 100 D Area CVPs be in compliance with revision 1 of the RDR/RAWP and SAP documents, while the 100 H CVP documents would be produced in compliance with the upcoming revision 2. ERC and the regulatory Project Managers took the action to decide this issue in a separate meeting.
- Burial Ground Record of Decision (ROD) Status - EPA (Dennis Faulk) stated that some minor changes and comment incorporation was still needed to complete this item. EPA, DOE, and ERC plan to meet offline for comment discussion/resolution. Dennis stated that the final draft ROD will be out for review by 8/31/00 and comments are due by COB 9/11/00. EPA also stated that they are concurrently reviewing the draft responsiveness summary for incorporation into the ROD. The final ROD is planned to be signed the week of 9/22/00.
- Five-Year ROD Review Status and ERC Comments Status on Document– ERC (Ella Coenenberg) stated that she was collecting ERC comments on this draft document. Ella stated that she would transmit the ERC comments via e-mail to the document's author, Larry Gadbois of EPA.
- Rick Bond of Ecology stated that he would be moving from his current position as the Project Manager for the 100 N Project to Ecology's Project Manager position for Temporary Transition Management. The 100 N Project Manager for Ecology will need to be filled.
- EPA (Dennis Faulk) discussed the current issue of adequate warning signs on the Columbia River along the 100 Areas. EPA stated that more specific signs need to be placed near remediation areas, especially to warn recreational boaters that the adjacent lands contain CERCLA, radioactively contaminated waste areas. EPA stated that it planned to present the issue at a Hanford Advisory Board meeting. DOE replied that it would respond as needed to EPA on this issue.

#### **100 H, F and K, Group 4**

- General Discussion/Status – not discussed.
- Rod Cave Waste Site Documentation (New Item) – EPA (Dennis Faulk) requested that ERC provide documentation for the Rod Cave waste site. This site, located at the 100 H Area, was not included in the original scope of remedial action work. However, the site was removed as the most convenient way to access adjacent pipeline that was within the original scope of work. EPA would like to review the documentation that identified and included the Rod Cave site as part of the Group 4 activities. ERC (Mark Buckmaster) has the action to support EPA's request.

**100 N**

- Janet Roth, ERC was introduced to attendees. Janet recently joined the 100 N Area Remedial Action Project as the Project Engineer.
- “Contained In Determination – ERC (Janet Roth) stated that 19 samples would be taken in support this activity during the next week. The samples, which are from the soil matrix, will be sent out for analysis with a two-week turnaround time requested.
- Revisions to the 100 N Area SAP – ERC (Jon Fancher) and Ecology (Rick Bond) discussed some minor comments to the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (DOE/RL-2000-07, Rev. 0). Both parties agreed to not incorporate the existing minor comments at this time, but collect additional future comments for a more substantial future revision.
- Revision of the RCRA Permit Due to Deferral of the Pipelines Around the “Golfball” – ERC (Ella Coenenberg) stated that ERC is working with all involved parties, including Fluor Daniel Hanford personnel, to complete permit revision for future submittal.
- 116-N-1 Air Monitoring Plan Status – ERC (Ella Coenenberg) stated that ERC would provide the document to the Washington Department of Health (Randy Axelrod) by 8/24/00, and upon the document’s return to ERC would then provide it to Ecology (Rick Bond) for review.
- 100 N Excavation Schedule (New Item) – ERC (Jon Fancher) stated that the 116-NR-3 Trench would be completed in about two weeks. Upon Trench completion, the subcontractor will perform remediation of several small 120 series sites. The 120 series represents small sites that received chemical releases during reactor operations; none of the 120 sites are radiologically contaminated. The 116-NR-3 Crib remediation will begin after the 120 series sites have been completed.

**100 B/C and D**

- General – ERC (Mark Sturges) stated the ERC would submit the necessary paperwork to take credit for the remediation of burial grounds adjacent to the pipelines in D Area.
- Cr(VI) Results From West Pipeline Segment at 100 D – ERC (Mark Sturges) stated that no analytical results were available for discussion at this time.
- Set Up Air Monitor Shutdown Tour at 100 D – ERC (Mark Sturges) took the action to set up the meeting with both Ecology (Wayne Soper) and Department of Health representatives. Mark stated that he would set up the meeting via e-mail.
- Review of B/C Pipeline Procurement Status – ERC (Mark Sturges) stated that the Requests For Proposal for the pipeline work were sent out to several potential bidders, and response was requested by 9/30/00.



- Tri-Party Agreement Milestone Negotiation, Involving B/C Pipelines – ERC (Alvin Langstaff) requested that ERC be permitted to assimilate the project's budget with the incoming bid information, prior to renegotiations with EPA of Tri-Party Agreement Milestone M-16-26B. EPA (Dennis Faulk) concurred with ERC's request, and instructed ERC to include this verbal concurrence information in the 110-Day Notice letter from ERC to EPA.
- Cr(VI) Status at 100 D - ERC (Mark Sturges) stated that no analytical results were available for discussion at this time.
- Cleanup Verification Status at 100 D – not discussed.
- 100 D "Hot Spot" Information (New Item) – ERC (Alvin Langstaff) discussed recent radiological contamination at 100 D Area. Radiological Controls Technicians (RCTs) were performing surveys for downposting of the pipeline trenches, in order to accommodate analytical sampling. However, RCT surveys detected two highly unusual hot spots. Due to the hot spot, downposting activities were stopped while the situation was evaluated. The hot spot contained radioactive elements that indicated the spot originated from fuel material. After evaluation, Radiological Controls staff developed a protocol to address presence of such particles. The downposting surveys resumed, now including requirements of minimal staff entry, full time RCT presence, and whole body surveys every half-hour for all personnel working in the area.
- The approved Backfill Concurrence Checklist form for 116-D-12 Sodium Dichromate Facility (Attachment 7) was entered in to the meeting minutes.

## Groundwater

- Dale Obenauer, ERC was introduced to attendees as the new Task Lead for the In Situ Redox Manipulation (ISRM) Project.
- 100-HR-3, 100-KR-4, and 100-NR-2 Pump and Treat System Status – ERC (Garrett Day) stated that the operations of all three pump and treat units are proceeding as planned. NR-2 well water levels are currently low, due to the correspondingly low water level for the Columbia River. ERC is working to keep a consistent operating flow rate in order to operate effectively. U.S. Filters was identified as HR-3 and Kr-4 resin regeneration contractor.
- In Situ Redox Manipulation (ISRM) Status – ERC (Dale Obenauer) provided the current ISRM status. ERC stated that injection operations had been initiated at 5 of 10 wells under the ISRM project. Of the 5 wells, reaction products removal had been completed at 3 wells and injections were ongoing at the other 2 wells. Of the 10 wells, 1 well has a low water level and will require augmented water levels in order to perform injection operations. ERC also stated that the wastewater pond for the ISRM activities was operating well, and bird protection was effective. DOE (Arlene Tortoso) asked ERC to check the actual evaporation rate occurring at the wastewater pond.
- ISRM Sodium Dichromate Spill – ERC (Dale Obenauer) discussed an 8/09/00 sodium dichromate spill at the 100-KR-4 site, in which a misaligned valve sent raw water to a chemical tanker. The

resulting spill discharged approximately 130 gallons of diluted product to the ground. The spill soil was analyzed, but did not display a Department of Transportation Reportable Quantity for the product. The contaminated soil was removed and staged, and will be disposed of at the Environmental Restoration Disposal Facility when a waste profile is completed.

- 100-KR-4 Discharge of Chromium Contaminated Groundwater – ERC (Garrett Day) stated that, during vessel realignments, some processed water was directed to the injection wells with a chromium value exceeding the ROD value. Project personnel are producing a lessons-learned on the incident, and responding to the Notice of Violation issued for the discharge incident.
- 100-HR-3 and 100-KR-4 Pump and Treat Hot Tap Replacement (New Item) – ERC (Joan Woolard) discussed ERC's proposed replacement of "hot taps," or valves that access well unit drain lines. The drain lines were originally installed in case an emergency occurred (such as power outages) when the year 2000 arrived. The taps are made of different material than the drain lines and have potential to separate from the lines during routine expansion and contraction of the lines. The replacement taps will be made of the same material as the drain lines. The tap replacement will require that the drain lines be emptied of residual water. ERC requested Ecology's and EPA's concurrence to consider the residual drain line water as purge water, and dispose of it by placing it in a purge water truck and perform disposal at the Modu Tanks. Ecology (Wayne Soper) agreed with this request. As Larry Gadbois, the 100-KR-4 Project Manager was not present during the meeting, he will be contacted at a later time to obtain his concurrence.

## APPROVED CVPs

Site Designation	Site Type	EPA/Ecology Signoff on WIDS Form	Processed by ERC WIDS Group
<b>BC Expedited Response Action Site</b>			
116-B-5	Crib, Trench	1/8/97	Complete
<b>BC Group 1 Sites</b>			
116-B-1	Trench	12/08/99	Complete
116-B-11	Retention Basin	12/08/99	Complete
116-B-13	South Sludge Trench	7/22/99	Complete
116-B-14	Trench	7/22/99	Complete
116-C-1	Retention Basin	1/21/99	Complete
116-C-5	Retention Basin	12/8/99	Complete
<b>BC Group 3 Sites</b>			
116-B-2	Fuel Storage Basin Trench	02/24/00	Complete
116-B-3	Crib	02/24/00	Complete
116-B-4	French Drain	2/24/00	Complete
116-B-6A/B-16	Crib/Storage Tanks	05/17/00	Complete
116-B-6B	Crib	02/24/00	Complete
116-B-9	French Drain	02/24/00	Complete
116-B-10	Dry Well	2/24/00	Complete
116-B-12	Crib	2/24/00	Complete
116-C-2A/B/C & OB	Crib/Pump Station	3/15/00	Complete
<b>D/DR Group 2 Sites</b>			
120-D-1	100-D Ponds	8/27/99	Complete
100-D-4 (107D5)	Sludge Pit	3/25/99	Complete
100-D-20 (107D3)	Sludge Pit	3/25/99	Complete
100-D-21 (107D2)	Sludge Pit	3/25/99	Complete
100-D-22 (107D1)	Sludge Pit	3/25/99	Complete
100-D-25	Unplanned Release	1/6/1999	Complete
1607-D-2	Septic Tank	11/23/99	Complete
1607-D2:1	Abandoned Tile Field	3/25/99	Complete
116-DR-9	Retention Basin	1/6/00	Complete
116-D-7	Retention Basin	8/15/00	
<b>D/DR Group 2 Pipelines</b>			
100-D/DR	Group 2 Pipeline Overburden Piles	3/30/00	Complete
<b>D/DR Group 3 Sites</b>			
116-D-3	French Drain	04/06/00	Complete
<b>D/DR Group 3 Pipelines</b>			
<b>H Group 4 Sites</b>			
116-H-6	Solar Evaporation Basins	5/13/97	Complete
<b>F Group 4 Sites</b>			

**100 Area Cleanup Verification  
Application of the MTCA 3-Part Test to Deep Zone  
100 Area Unit Managers Meeting -- August 22, 2000**

**Issue:** In CVPs issued prior to the 116-D-7 CVP, the MTCA 3-Part Test was applied to the shallow zone only. During preparation of the 116-D-7 CVP, Ecology requested that the 3-Part Test also be applied to the deep zone.

**Actions:** The 116-D-7 CVP and all subsequent CVPs issued to date document application of the 3-Part Test to the deep zone. In addition, an evaluation was performed to apply the 3-Part Test to those sites for which CVPs were issued prior to the 116-D-7 CVP. The evaluation is documented in ERC Calculation Brief No. 0100X-CA-V0033.

**Results:** With one exception, for CVPs issued prior to the 116-D-7 CVP, no COCs failed the MTCA 3-Part Test in the deep zone that had not already had RESRAD modeling performed to demonstrate protectiveness of groundwater and the Columbia River. The exception was for the 116-B-14 site where the MTCA 10% criterion was not met (one sample out of four [25%] exceeded the RAG of 18.5 mg/kg). Therefore, additional RESRAD modeling was performed to demonstrate that residual total chrome concentrations at 116-B-14 are protective of groundwater and the Columbia River; this modeling is documented in ERC Calculation Brief 0100X-CA-V0037.

**Conclusion:** The "Statement of Protectiveness" in each affected CVP requires no change. It is recommended that this summary be entered into the administrative record to document these additional evaluations.

**100 Area Cleanup Verification  
Evaluation of More Restrictive  
Total Chromium Groundwater Protection RAG  
100 Area Unit Managers Meeting -- August 22, 2000**

**Issue:** The ERC has identified that the groundwater standard used in CVPs, to date, for total chromium is not the most restrictive standard. To date, CVPs have used the MTCA Level B value of 16,000 micrograms/liter. The most restrictive standard is, in fact, 100 micrograms/liter per Chapter 246-290 of the Washington Administrative Code. Consequently, there is a need to evaluate past CVPs for compliance against the more restrictive standard.

**Actions:** Attainment of the groundwater protection RAG for total chromium was reevaluated for all CVPs issued to date. The evaluation identified three cases where total chromium concentrations met the soil RAG based on the previously used groundwater standard but failed when using the soil RAG based on the more restrictive standard. These cases are:

- 116-B-14 Shallow Zone
- 116-B-14 Deep Zone
- 116-C-5 Deep Zone Level 2

For these cases, additional RESRAD modeling was performed to demonstrate protectiveness of groundwater. These evaluations are documented in ERC Calculation Brief No. 0100X-CA-V0037.

**Results:** The evaluation of all 100 Area waste sites where total chromium was a COC determined that residual total chromium concentrations are protective of groundwater.

**Conclusion:** The "Statement of Protectiveness" in each affected CVP requires no change. It is recommended that this summary be entered into the administrative record to document these additional evaluations.

<b>Waste Site:</b> <b>100-D-12</b> <b>Sodium</b> <b>Dichromate</b> <b>Facility</b>	<b>BACKFILL CONCURRENCE CHECKLIST</b> (Concurrence to Proceed with Waste Site Backfill Operations)			<b>WIDS No.:</b> <b>100-D-12</b>
This checklist is a summary of cleanup verification results for the 100-D-12 Sodium Dichromate Facility. The checklist is intended as an agreement allowing the ERC subcontractor to backfill this site prior to the issuance of the final cleanup verification package. The lead regulatory agency has been provided copies of detailed calculations. The results are summarized below.				
Regulatory Requirement	Remedial Action Goals (RAG)	Results	RAG Attained	Ref.
Direct Exposure – Radionuclides	1. Attain 15 mrem/yr dose rate above background over 1000 years.	1. No radionuclide COCs were identified for this site.	NA	NA
Direct Exposure – Nonradionuclides	1. Attain individual COC RAGs.	1. The individual COC concentration is below the RAG.	Yes	A
Meet Nonradionuclide Risk Requirements	1. Hazard index of <1 for noncarcinogens.	1. The individual COC hazard index is below 1.	Yes	A
	2. Cumulative hazard index of <1 for noncarcinogens.	2. The cumulative hazard index is below 1.		A
	3. Excess cancer risk of <1 x 10 <sup>-6</sup> for individual carcinogens.	3. The individual COC excess cancer risk is less than 1 x 10 <sup>-6</sup> .		A
	4. Attain a cumulative excess cancer risk of <1 x 10 <sup>-5</sup> for carcinogens.	4. The cumulative excess cancer risk is less than 1 x 10 <sup>-5</sup> .		A
Groundwater/River Protection – Radionuclides	1. Attain single COC groundwater & river RAGs.	No radionuclide COCs were identified for this site.	NA	NA
	2. Attain National Primary Drinking Water Regulations 4-mrem/yr (beta/gamma) dose standard to target receptor/organ.			
	3. Meet National Primary Drinking Water Regulations 15 pCi/L (alpha activity) standard.			
	4. Meet total uranium standard of 30 pCi/L.			
Groundwater/River Protection – Nonradionuclides	1. Attain individual nonradionuclide groundwater & river RAGs.	1. All the groundwater and river RAGs have been attained.	Yes	A
Other Supporting Information	1. Sample variance calculation			B
	2. Sample location design			C

All citations above and references on attached sheet are on record with Bechtel Hanford, Inc., Document and Information Services. Above noted regulatory requirements have been attained.

<i>[Signature]</i>	8/23/00	<i>[Signature]</i>	8-21-00	<i>[Signature]</i>	8/21/00
BHI Task Manager	Date	BHI Project Engineer	Date	DOE Project Manager	Date

Given the attached information, DOE can proceed with backfill of the site with minimal risk. Final approval that the site has met RAOs and RAGs will occur with the submittal, review, and approval of the Cleanup Verification Package by the lead regulatory agency.

N/A	N/A	<i>[Signature]</i>	8-24-00
EPA Project Manager	Date	Ecology Project Manager	Date

### Backfill Concurrence Checklist Attachments/References

Attachment/ Reference	Description
A	100-D-12 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone), 0100D-CA-V0129, Rev. 0
B	100-D-12 Pump Station Sample Variance, 0100D-CA-V0110, Rev. 0
C	100-D-12 Shallow Zone Sample Location Design, 0100D-CA-V0109, Rev. 0 0

**Attachments:**

*Calculation Briefs*



**Attachment A**

*100-D-12 95% UCL Calculations for Compliance  
with Cleanup Standards (Shallow Zone),  
0100D-CA-V0129, Rev. 0*

# CALCULATION COVER SHEET

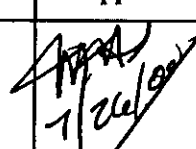
<b>Project Title:</b>	100-D-12 Site Closeout	<b>Job No.</b>	22192
<b>Area</b>	100-D		
<b>Discipline</b>	Environmental	<b>Calc. No.</b>	0100D-CA-V0129
<b>Subject</b>	100-D-12 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone)		
<b>Computer Program</b>	Excel	<b>Program No.</b>	Excel 97

Committed Calculation

X

Preliminary

Superseded

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 6	J. M. Routt  7/13/00	J.B. Miley T.B. Miley	KEC 7/20/00	 7/26/00 F.M. Corpuz	7/27/00
	Total = 7		L.E. Ivey 7/13/00 L.E. Ivey			

## SUMMARY OF REVISIONS


Bechtel Hanford, Inc.

ERC TEAM

## CALCULATION SHEET

Originator	T.M. Rount <i>Jme</i>	Date	07/13/00	Calc. No.	0100D-CA-V0129	Rev. No.	0
Project	100-D-12 Site Closeout	Job No.	22192	Checked	T.B. Miley <i>ABM</i> L.E. Ivey <i>LI</i>	Date	7/19/00 7/13/00
Subject	100-D-12 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone)					Sheet No.	1 of 6

**Problem:**

Calculate the requisite statistics to evaluate compliance with cleanup standards for 100-D-12 shallow zone as required by the Instruction Guide (IG) (100-IG-G0001, Rev. 1); these statistical values will also be used to determine compliance with groundwater and river protection criteria. Also, calculate the carcinogenic risk for applicable nonradionuclide analytes (shallow zone only), MTCA 3-part test (all nonradionuclide analytes), and the relative percent difference (RPD) for each contaminant of concern (COC).

**Given/References:**

- 1) Sample Results: Cleanup verification data consist of results from 100-D-12 Pump Station Sample Variance (Calc No. 0100D-CA-V0110, Rev. 0).
- 2) Lookup values from Remedial Design Report/Remedial Action Work Plan (RDR/RAWP) (DOE-RL 1998b).
- 3) DOE-RL, 1998a, 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-98-22, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 4) DOE-RL, 1998b, Remedial Design Report/Remedial Action Work Plan for the 100 Area, DOE/RL-98-17, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 5) BHL, 1999, Instruction Guide for the Remediation of the 100-BC-1, 100-DR-1, and 100-HR-1 Waste Sites, 0100X-IG-G0001, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.
- 6) Model Toxics Control Act, Washington Administrative Code-173-340, and Statistical Guidance for Ecology Site Managers, Ecology Pub. #92-54, Washington Department of Ecology, Olympia, Washington.
- 7) Ecology, 1993, Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-Detection Limit or Below-PQL Values (Censored Data Sets).
- 8) EPA, 1994, WSEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013.
- 9) Calculation of Hexavalent Chromium Carcinogenic Risk (Calc No. 0100X-CA-00031, Rev. 0).

**Solution:**

Calculation methodology is described in Ecology Pub. #92-54, below, and in Attachment A-1 of the SAP. Use data from attached worksheets to calculate the 95% upper confidence limit (UCL) for each analyte, carcinogenic risk and perform the MTCA 3-part test for nonradionuclides, and RPD calculations for each COC.

**Calculation Description:**

The subject calculations were performed on data from soil samples from waste site 100-D-12. The data were entered into an EXCEL 97 spreadsheet and calculations performed by utilizing the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP is documented by this calculation. Split and duplicate RPD results are used in evaluation of data quality and are presented in the Cleanup Verification Package (CVP) for this site.

**Methodology:**

The statistical value calculated to evaluate the effectiveness of cleanup was the 95% UCL. For nonradioactive analytes with > 50% of the data below detection limits, the maximum value for the sample data was used instead of the 95% UCL. All nonradionuclide (i.e., hexavalent chromium) data reported as being below detection limit were set to 1/2 the detection limit value for calculation of the statistics (Ecology, 1993).

For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

The MTCA statistical guidance suggests that a test for distributional form be performed on the data, and the 95% UCL calculated on the appropriate distribution. For small data sets ( $n < 10$ ), the calculations are performed assuming a nonparametric distribution, so no test for distribution is required.

The estimated hazard quotient (for applicable nonradionuclide COCs) is determined by dividing the statistical value (derived in this calculation) by the MTCA B noncarcinogenic cleanup limit. The nonradionuclide carcinogenic risk, above background, is determined by dividing the statistical value by the MTCA B carcinogenic cleanup limit and then multiplying by  $10^{-4}$ . For data sets where all values are below detection, neither of these calculations are required. For noncarcinogenic nonradionuclide COCs, only the estimated fraction of risk computation must be performed.

The MTCA 3-part test determines if:

- 1) the statistical value exceeds the most stringent cleanup limit for each nonradionuclide COC,
- 2) greater than 10% of the raw data exceed the most stringent cleanup limit for each nonradionuclide COC,
- 3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each nonradionuclide COC.

The 3-part test is performed for nonradionuclide analytes found in overburden, the shallow zone, and the deep zone, as necessary.

The RPD is performed when both the main value and, either, the duplicate, split, or regulator split values are greater than 5 times the target detection limit (TDL). These RPD calculations use the following formula:  $RPD = \frac{|M-S|}{(M+S)/2} \times 100$

where, M = Main Sample Value  
D = Split (or duplicate) Sample Value

For QA/QC split and duplicate RPD calculations, a value below  $\pm 30\%$  indicates the data compare favorably. For regulatory splits, a threshold of  $\pm 35\%$  is used (EPA 540/R-94/013). If the RPD is greater than  $\pm 30\%$  (or  $\pm 35\%$  for regulatory split data), further investigation regarding the usability of the data is performed.

If regulator splits comparison is required, an additional parameter is evaluated. A control limit of  $\pm 2$  times the TDL shall be used if either the main or regulator split value is less than 5 times the TDL and above detection. In the case where only one result is above the five times the TDL and the other is below, the  $\pm 2$  times the TDL criteria applies. Therefore the following calculation is performed during these two cases involving regulator split data:

difference = main - regulator split

If the difference is greater than  $\pm 2$  times the TDL, then further investigation regarding the usability of the data is performed.

Bechtel Hanford, Inc.

ERC TEAM

## CALCULATION SHEET

Originator T.M. Routh *Jmr* Date 07/13/00 Calc. No. 0100D-CA-V0129 Rev. No. 0  
 Project 100-D-12 Site Closeout Job No. 22192 Checked T.B. Miley *JBM* Date 7/19/00  
 L.E. Ivey *LI*  
 Subject 100-D-12 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone) Sheet No. 7/13/00  
 2 of 6

**Results:**

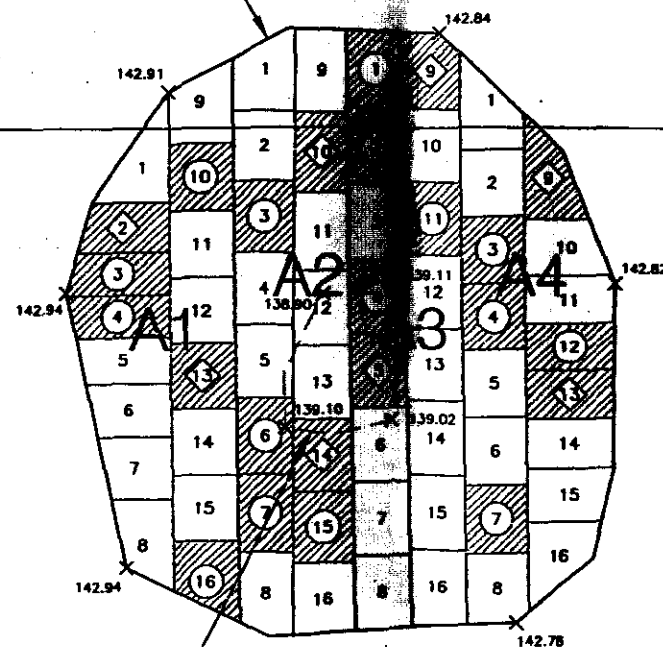
The results presented in the summary tables that follow are for use in RESRAD dose/risk analysis, as applicable, and the Cleanup Verification Package (CVP) for this site.

<b>Result Summary - Shallow Zone</b>				
100-D-12 Shallow Zone Sample Data, SDG No. H0828 and H0829.				
Cr+6	5.6E-01 U		mg/kg	
<b>MTCA Evaluation (Shallow Zone)</b>				
<b>MTCA 3-Part Test:</b>				
95% UCL > Cleanup Limit?		NO		
> 10% above Cleanup Limit?		NO		
Any sample > Cleanup Limit?		NO		
<b>Risk Estimate:</b>				
Hazard quotient for each nonradionuclide:			NA	
Risk for each carcinogenic nonradionuclide:			NA	
<b>Relative Percent Difference (RPD) Results (Shallow Zone)</b>				
<b>QA/QC Analysis</b>				
Analyte	Duplicate Analysis	Split Analysis	Duplicate Analysis	Split Analysis
Cr+6				

All hexavalent chromium results are below detection; therefore, calculation of RPD is not required.



N 151410

TOP OF EXCAVATION/SLOPE  
100-D-12BOTTOM OF EXCAVATION/SLOPE  
100-D-12

SCALE 1:200

2 0 2 4 8 meters

 U.S. DEPARTMENT OF ENERGY  
 DOE FIELD OFFICE, RICHLAND  
 HANFORD ENVIRONMENTAL RESTORATION PROGRAM

## NOTES

1. SHALLOW ZONE NODE AREAS ARE APPROXIMATELY 3.16 SQUARE METERS.
2. SAMPLES IS TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE SHALLOW ZONE CONSISTS OF SAMPLING AREAS A1, A2, A3 AND A4 WITHIN DECISION SUBUNIT 1.
4. ALL ELEVATIONS SHOWN ARE REFERENCED TO NGVD29 VERTICAL DATUM.  
SUBCONTRACT BASE EXCAVATION ELEVATION: EL 140.06  
TOP OF BACKFILL: EL 142.50

## LEGEND



CLOSEOUT VERIFICATION SAMPLING NODE

GAMMA ENERGY ANALYSIS  
SAMPLING NODE

## SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	A1-2	151407.29	573345.52
		A1-3	151406.02	573345.39
		A1-4	151404.85	573345.41
		A1-10	151408.67	573347.62
		A1-13	151403.19	573347.73
		A1-16	151397.56	573347.85
	A2	A2-3	151407.58	573349.31
		A2-6	151401.55	573349.39
		A2-7	151399.44	573349.41
		A2-10	151409.32	573350.86
		A2-14	151401.00	573350.96
		A2-15	151399.04	573350.99
	A3	A3-1	151411.58	573352.28
		A3-2	151409.49	573352.33
		A3-4	151405.37	573352.43
		A3-5	151403.32	573352.48
		A3-9	151411.54	573353.83
		A3-11	151407.52	573353.93
	A4	A4-3	151406.66	573355.61
		A4-4	151404.82	573355.65
		A4-7	151399.26	573355.76
		A4-9	151408.61	573357.10
		A4-12	151404.00	573357.73
		A4-13	151402.67	573357.74

 Attachment 3 Sheet No. 1 of 1  
 Originator G. CIVIL Date 4-25-00  
 Chk'd by R.B. KERRON ROK Date 4-26-00  
 Calc. No. 0100 D-CA-VOL 09 Rev. No. 0

ATTACHMENT 3

 100 D AREA  
 100 AREA REMEDIAL DESIGN  
 100-D-12 SHALLOW ZONE SAMPLING PLAN

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
1	Bechtel Hanford, Inc.										ERC TEAM									
2																				
3	CALCULATION SHEET																			
4																				
5	Originator	T.M. Roult <i>Jmr</i>										Date	07/13/2000		Calc. No.:	0100D-CA-V0129		Rev. No.	0	
6	Project	100-D-12 Site Closeout										Job No.	22192		Checked by:	T.B. Miley <i>JBM</i>		Date	7/19/00	
7	Subject	100-D-12 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone)														L.E. Ivey <i>LEI</i>		Date	7/13/00	
8																				
9																				
10	Split/Duplicate Analysis:																			
11		HEIS Number	Cr+6 (mg/kg)																	
12			Result	PQL																
13	Shallow Zone																			
14																				
15																				
16	Duplicate of B0Y2L9	B0Y2N7	4.2E-01	U	4.2E-01															
17	Duplicate of B0Y2N5	B0Y2N9	4.1E-01	U	4.1E-01															
18	Split of B0Y2L9	B0Y2P0	8.0E-02	U	8.0E-02															
19	Split of B0Y2N5	B0Y2P1	8.0E-02	U	8.0E-02															
20																				
21	(TDL)		0.1																	
22	Duplicate Analysis	Both > MDA?	=IF(C\$14="NA","NA",IF(C\$16="NA","NA",IF(AND(C\$14>E\$14,C\$16>E\$16),"Yes (continue)","No-Stop (acceptable)"))))																	
23		Both > 5xTDL?	=IF(C23="NA","NA",IF(C23="No-Stop (acceptable)","",IF(AND(C\$14>(5*C\$22),C\$16>(5*C\$22)),"Yes (calc RPD)","No-Stop (acceptable)"))))																	
24		RPD	=IF(C23="NA","NA",IF(C23="No-Stop (acceptable)","",IF(C24="Yes (calc RPD)",+(ABS((C\$14-C\$16)/((C\$14+C\$16)/2))),"")))																	
25	Split Analysis	Both > MDA?	=IF(C\$14="NA","NA",IF(C\$18="NA","NA",IF(AND(C\$14>E\$14,C\$18>E\$18),"Yes (continue)","No-Stop (acceptable)"))))																	
26		Both > 5xTDL?	=IF(C29="NA","NA",IF(C29="No-Stop (acceptable)","",IF(AND(C\$14>(5*C\$22),C\$18>(5*C\$22)),"Yes (calc RPD)","No-Stop (acceptable)"))))																	
27		RPD	=IF(C29="NA","NA",IF(C29="No-Stop (acceptable)","",IF(C30="Yes (calc RPD)",+(ABS((C\$14-C\$18)/((C\$14+C\$18)/2))),"")))																	
28																				

Type in same list of analytes as in RPD analysis and 95% UCL.
Type in HEIS number and values from Table A-1 for original samples.
Type in HEIS number and values from Table A-1 for QA/QC duplicate samples.
Type in HEIS number and values from Table A-1 for QA/QC split samples.
Type in target detection limit (TDL) from SAP.
Checks to see if both original and duplicate samples are below the minimum detectable activity (MDA) for radionuclides or practical quantitation limit (PQL) for nonradionuclides. If "No-Stop (acceptable)", RPD analysis is not required.
Checks to see if both original and duplicate samples are above 5 times the target detection limit (TDL). If "Yes (calc RPD)" then RPD analysis is required.
Calculates relative percent difference (RPD) between the original and the duplicate results. If the above steps indicate an RPD calculation is required, the RPD value will calculate automatically. If the RPD is greater than 30% the value will be in italics.
Process is the same for split RPD analysis as for duplicate RPD analysis. For RPD analysis of duplicate and QA/QC split data the comparison percentage is +/-30%.

	A	B	C	D	E	F	G	H	I	J	K	L					
1	Bechtel Hanford, Inc.					ERC TEAM											
2																	
3	CALCULATION SHEET																
4																	
5	Originator	T.M. Routt Jmr				Date	07/13/00		Calc. No.	0100D-CA-V0129		Rev. No.	0				
6	Project	100-D-12 Site Closeout				Job No.	22192		Checked	T.B. Milley JRM		Date	7/19/00				
7	Subject	100-D-12 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone)							L.E. Ivey LT			Sheet No.	5 of 6				
8																	
9																	
10	100-D-12 Shallow Zone Sample Data, SDG No. H0828 and H0829.				Non-radioactive COC Formulas												
11	Sampling Area	HEIS Number	Sample Date	Cr+6 mg/kg	Q												
12	A1-2	BOY2L3	05/01/00	4.2E-01	U	Data manually entered from SDG deliverable package. Qualifiers assigned according to the data package or available data validation package.											
13	A1-3	BOY2L4	05/01/00	4.2E-01	U												
14	A1-4	BOY2L5	05/01/00	4.2E-01	U												
15	A1-10	BOY2L6	05/01/00	4.2E-01	U												
16	A1-13	BOY2L7	05/01/00	4.1E-01	U												
17	A1-16	BOY2L8	05/01/00	4.4E-01	U												
18	A2-3	BOY2L9	05/01/00	4.2E-01	U												
19	A2-6	BOY2M0	05/01/00	4.2E-01	U												
20	A2-7	BOY2M1	05/01/00	4.2E-01	U												
21	A2-10	BOY2M2	05/01/00	4.2E-01	U												
22	A2-14	BOY2M3	05/01/00	4.1E-01	U												
23	A2-15	BOY2M4	05/01/00	4.3E-01	U												
24	A3-1	BOY2M5	05/01/00	4.2E-01	U												
25	A3-2	BOY2M6	05/01/00	4.2E-01	U												
26	A3-4	BOY2M7	05/01/00	4.0E-01	U												
27	A3-5	BOY2M8	05/01/00	4.1E-01	U												
28	A3-9	BOY2M9	05/01/00	4.1E-01	U												
29	A3-11	BOY2N0	05/01/00	4.2E-01	U												
30	A4-3	BOY2N1	05/01/00	5.6E-01	U												
31	A4-4	BOY2N2	05/01/00	4.2E-01	U												
32	A4-7	BOY2N3	05/01/00	4.3E-01	U												
33	A4-9	BOY2N4	05/01/00	4.1E-01	U												
34	A4-12	BOY2N5	05/01/00	4.1E-01	U												
35	A4-13	BOY2N6	05/01/00	4.2E-01	U												
36	Duplicate of BOY2L9	BOY2N7	05/01/00	4.2E-01	U												
37	Duplicate of BOY2N5	BOY2N8	05/01/00	4.1E-01	U												
38																	
39																	
40	Statistical Computation Input Data (For rad, MDA used for nondetects. For nonrad, 1/2 DL used for nondetects. Dup/Main samples averaged)																
41	Sampling Area	HEIS Number	Sample Date	Cr+6 mg/kg	Q												
42	A1-2	BOY2L3	05/01/00	=IF(D13="","IF(E13="U",D13/2,D13))		An "IF" comparison is used to determine appropriate input value. If the data is qualified with a "U", then half the detection limit is taken as the input value, otherwise, the reported result is used.											
43	A1-3	BOY2L4	05/01/00	=IF(D14="","IF(E14="U",D14/2,D14))													
44	A1-4	BOY2L5	05/01/00	=IF(D15="","IF(E15="U",D15/2,D15))													
45	A1-10	BOY2L6	05/01/00	=IF(D16="","IF(E16="U",D16/2,D16))													
46	A1-13	BOY2L7	05/01/00	=IF(D17="","IF(E17="U",D17/2,D17))													
47	A1-16	BOY2L8	05/01/00	=IF(D18="","IF(E18="U",D18/2,D18))													
48	A2-3	BOY2L9	05/01/00	=AVERAGE(IF(COUNTIF(E19,"U")=1,D19/2,D19),IF(COUNTIF(E37,"U")=1,D37/2,D37))													
49	A2-6	BOY2M0	05/01/00	=IF(D20="","IF(E20="U",D20/2,D20))													
50	A2-7	BOY2M1	05/01/00	=IF(D21="","IF(E21="U",D21/2,D21))													
51	A2-10	BOY2M2	05/01/00	=IF(D22="","IF(E22="U",D22/2,D22))													
52	A2-14	BOY2M3	05/01/00	=IF(D23="","IF(E23="U",D23/2,D23))													
53	A2-15	BOY2M4	05/01/00	=IF(D24="","IF(E24="U",D24/2,D24))													
54	A3-1	BOY2M5	05/01/00	=IF(D25="","IF(E25="U",D25/2,D25))													
55	A3-2	BOY2M6	05/01/00	=IF(D26="","IF(E26="U",D26/2,D26))													
56	A3-4	BOY2M7	05/01/00	=IF(D27="","IF(E27="U",D27/2,D27))													
57	A3-5	BOY2M8	05/01/00	=IF(D28="","IF(E28="U",D28/2,D28))													
58	A3-9	BOY2M9	05/01/00	=IF(D29="","IF(E29="U",D29/2,D29))													
59	A3-11	BOY2N0	05/01/00	=IF(D30="","IF(E30="U",D30/2,D30))													
60	A4-3	BOY2N1	05/01/00	=IF(D31="","IF(E31="U",D31/2,D31))													
61	A4-4	BOY2N2	05/01/00	=IF(D32="","IF(E32="U",D32/2,D32))													
62	A4-7	BOY2N3	05/01/00	=IF(D33="","IF(E33="U",D33/2,D33))													
63	A4-9	BOY2N4	05/01/00	=IF(D34="","IF(E34="U",D34/2,D34))													
64	A4-12	BOY2N5	05/01/00	=AVERAGE(IF(COUNTIF(E35,"U")=1,D35/2,D35),IF(COUNTIF(E38,"U")=1,D38/2,D38))													
65	A4-13	BOY2N6	05/01/00	=IF(D36="","IF(E36="U",D36/2,D36))													
66																	
67	Statistical Computations																
68	Statistical value based on				Cr+6												
69					Default to Maximum Value												
70																	
71	% < Detection Limit				=COUNT(D43:D66)	Basis for the statistical value is assumed normal and computed as the 95% UCL using Z-statistic method, unless MTCASat analysis indicates another distribution and appropriate 95% UCL (for sample sets greater than 10), or, for greater than 50% censored data (<DL), the maximum value of the data set is used. This cell counts the number of statistical computation input values. Determines the % of raw data above detection. Note that for main/duplicate samples pairs, results are considered less than detection in cases where either the main, duplicate or both have "U" qualifiers. One is subtracted from the count of "U" qualifiers when the number of "U" qualifiers for the main and duplicate is equal to or greater than one. Computes the arithmetic average based on the statistical input values (adjusted for censored data, after 1/2 DL replacement). Computes the arithmetic standard deviation based on the statistical input values (adjusted for censored data, after 1/2 DL replacement). Computes the Z-statistic for the single tailed 95% UCL, or, displays "NA" in cases where the 95% UCL has been determined using MTCASat. Computes the 95% UCL, or, displays the appropriate 95% UCL in cases where the 95% UCL has been determined using MTCASat (the value is manually entered in such cases). Column I determines and displays the maximum of the input data set based on the statistical input values (adjusted for censored data, after 1/2 DL replacement). Column J examines the range of values in the raw data for the corresponding value in Column I and displays its qualifier. Column I simply reiterates the appropriate statistical value from above, or if 50% or less than detection limit the maximum value is used. Column J uses an "IF" comparison so that a "U" qualifier is displayed in cases where greater than 50% of the data is censored (e.g. "U" qualified).											
72					=COUNTIF(E13:E38,"U")-IF((COUNTIF(E19,"U")>COUNTIF(E37,"U"))>1,1,0)-IF((COUNTIF(E35,"U")>COUNTIF(E38,"U"))>1,1,0)/(COUNT(D13:D38)-2)												
73	mean				=AVERAGE(D43:D66)												
74	st. dev.				=STDEV(D43:D66)												
75	Z-statistic				=NORMINV(0.95,0,1)												
76	95%UCL on mean				=D73+((D75*D74/(SQRT(D71))))												
77	max value				=MAX(D13:D38)												
78	Statistical value				=IF(D72>0.5,D77,D76)												
79	Background				NA												
80	Statistical value above background				=D78												
81	MTCA 3-PART TEST:																
82	Most Stringent Nonradioactive Cleanup Limit				2.1	Human Health Protection				Manually entered most stringent cleanup limit.							
83	95% UCL > Cleanup Limit?				=IF(D80>D84,"YES","NO")					An "IF" comparison is used to display "YES" if the statistical value set exceeds the most stringent cleanup limit.							
84	> 10% above Cleanup Limit?				=IF(COUNTIF(D13:D38,">2.1")/D71>0.1,"YES","NO")					An "IF" comparison is used to display "YES" if greater than 10% of the data set exceeds the most stringent cleanup limit.							
85	Any sample > 2X Cleanup Limit?				=IF(D77>D84*2,"YES","NO")					An "IF" comparison is used to display "YES" if the maximum value of the data set exceeds twice the most stringent cleanup limit. Note that if the maximum is less than twice the MTCA B limit, so are all the other sample results and no additional comparison of the data set is needed.							
86	RISK EVALUATION:																
87	MTCA B Noncarcinogenic Cleanup:				400					Manually entered MTCA B noncarcinogenic cleanup limit value.							
88	Hazard quotient for each nonradioactive:				NA					Computes the estimated hazard quotient (statistical value divided by the noncarcinogenic cleanup limit). Except if the results are less than detection (100% censored data set) as indicated by "U", or below background in which case NA is entered.							
89	MTCA B Carcinogenic Cleanup:				2.1					Manually entered MTCA B carcinogenic cleanup limit value.							
90	Risk for each carcinogenic nonradioactive:				NA					An estimated of carcinogenic risk is calculated by dividing the statistical value by the MTCA B carcinogenic cleanup limit and multiplying by 10* for detected carcinogenic COCs above background. "NA" is manually entered for noncarcinogenic COCs and when all raw sample values for a COC are below detection or below background.							
91	NONRADIOACTIVE SUMMARY:																
92	All sample results are below detection.																
93	MTCA Compliance?				=IF(COUNTIF(D85:D87,"YES")>0,"NO","YES")												
94	Nonrad noncarcinogenic sum of quotients:				NA												
95	Nonrad carcinogenic risk:				NA												

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Bechtel Hanford, Inc.														
2	CALCULATION SHEET														
3															
4	Originator	T.M. Routt	Date	07/13/2000	Calc. No.:	0100D-CA-V0129	Rev. No.	0							
5	Project	100-D-12 Site Closeout	Job No.	22192	Checked by:	T.B. Miley	Date	7/19/00							
6						L.E. Ivey		7/13/00							
7	Subject	100-D-12 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone)										Sheet No.	4 of 6		
8															
9															
10	Split/Duplicate Analysis:														
11		HEIS Number		Cr+6 (mg/kg)											
12				Result		PQL									
13	QA/QC Duplicate/Split Results														
14															
15															
16	Duplicate of	B0Y2L9	B0Y2N7	4.2E-01	U	4.2E-01									
17	Duplicate of	B0Y2N5	B0Y2N9	4.1E-01	U	4.1E-01									
18	Split of	B0Y2L9	B0Y2P0	8.0E-02	U	8.0E-02									
19	Split of	B0Y2N5	B0Y2P1	8.0E-02	U	8.0E-02									
20															
21	Shallow Zone Analysis:														
22		(TDL)		0.1											
23	Duplicate Analysis (A2-3)	Both >	PQL?	No-Stop (acceptable)											
24		Both >	5xTDL?												
25		RPD													
26	Duplicate Analysis (A4-12)	Both >	PQL?	No-Stop (acceptable)											
27		Both >	5xTDL?												
28		RPD													
29	Split Analysis (A2-3)	Both >	PQL?	No-Stop (acceptable)											
30		Both >	5xTDL?												
31		RPD													
32	Split Analysis (A4-12)	Both >	PQL?	No-Stop (acceptable)											
33		Both >	5xTDL?												
34		RPD													



	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2													
4	Originator	T.M. Roult	Jmr	Date	07/13/00	Calc. No.	0100D-CA-V0129	Rev. No.	0				
5	Project	100-D-12 Site Closeout		Job No.	22192	Checked	T.B. Miley	Date	7/19/00				
6							L.E. Ivey		7/13/00				
7	Subject	100-D-12 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone)						Sheet No.	3 of 6				
8													
10	100-D-12 Shallow Zone Sample Data, SDG No. H0828 and H0829.												
11	Sampling	HEIS	Sample	Cr+6									
12	Area	Number	Date	mg/kg	Q								
13	A1-2	B0Y2L3	05/01/00	4.2E-01	U								
14	A1-3	B0Y2L4	05/01/00	4.2E-01	U								
15	A1-4	B0Y2L5	05/01/00	4.2E-01	U								
16	A1-10	B0Y2L6	05/01/00	4.2E-01	U								
17	A1-13	B0Y2L7	05/01/00	4.1E-01	U								
18	A1-16	B0Y2L8	05/01/00	4.4E-01	U								
19	A2-3	B0Y2L9	05/01/00	4.2E-01	U								
20	A2-6	B0Y2M0	05/01/00	4.2E-01	U								
21	A2-7	B0Y2M1	05/01/00	4.2E-01	U								
22	A2-10	B0Y2M2	05/01/00	4.2E-01	U								
23	A2-14	B0Y2M3	05/01/00	4.1E-01	U								
24	A2-15	B0Y2M4	05/01/00	4.3E-01	U								
25	A3-1	B0Y2M5	05/01/00	4.2E-01	U								
26	A3-2	B0Y2M6	05/01/00	4.2E-01	U								
27	A3-4	B0Y2M7	05/01/00	4.0E-01	U								
28	A3-5	B0Y2M8	05/01/00	4.1E-01	U								
29	A3-9	B0Y2M9	05/01/00	4.1E-01	U								
30	A3-11	B0Y2N0	05/01/00	4.2E-01	U								
31	A4-3	B0Y2N1	05/01/00	5.6E-01	U								
32	A4-4	B0Y2N2	05/01/00	4.2E-01	U								
33	A4-7	B0Y2N3	05/01/00	4.3E-01	U								
34	A4-9	B0Y2N4	05/01/00	4.1E-01	U								
35	A4-12	B0Y2N5	05/01/00	4.1E-01	U								
36	A4-13	B0Y2N6	05/01/00	4.2E-01	U								
37	Duplicate of B0Y2L9	B0Y2N7	05/01/00	4.2E-01	U								
38	Duplicate of B0Y2N5	B0Y2N9	05/01/00	4.1E-01	U								
39													
40	Statistical Computation Input Data (For rad,												
41	Sampling	HEIS	Sample	Cr+6	Q								
42	Area	Number	Date	mg/kg									
43	A1-2	B0Y2L3	05/01/00	2.1E-01									
44	A1-3	B0Y2L4	05/01/00	2.1E-01									
45	A1-4	B0Y2L5	05/01/00	2.1E-01									
46	A1-10	B0Y2L6	05/01/00	2.1E-01									
47	A1-13	B0Y2L7	05/01/00	2.1E-01									
48	A1-16	B0Y2L8	05/01/00	2.2E-01									
49	A2-3	B0Y2L9/ B0Y2N7	05/01/00	2.1E-01									
50	A2-6	B0Y2M0	05/01/00	2.1E-01									
51	A2-7	B0Y2M1	05/01/00	2.1E-01									
52	A2-10	B0Y2M2	05/01/00	2.1E-01									
53	A2-14	B0Y2M3	05/01/00	2.1E-01									
54	A2-15	B0Y2M4	05/01/00	2.2E-01									
55	A3-1	B0Y2M5	05/01/00	2.1E-01									
56	A3-2	B0Y2M6	05/01/00	2.1E-01									
57	A3-4	B0Y2M7	05/01/00	2.0E-01									
58	A3-5	B0Y2M8	05/01/00	2.1E-01									
59	A3-9	B0Y2M9	05/01/00	2.1E-01									
60	A3-11	B0Y2N0	05/01/00	2.1E-01									
61	A4-3	B0Y2N1	05/01/00	2.8E-01									
62	A4-4	B0Y2N2	05/01/00	2.1E-01									
63	A4-7	B0Y2N3	05/01/00	2.2E-01									
64	A4-9	B0Y2N4	05/01/00	2.1E-01									
65	A4-12	B0Y2N5/ B0Y2N9	05/01/00	2.1E-01									
66	A4-13	B0Y2N6	05/01/00	2.1E-01									
67													
68	Statistical Computations												
69				Cr+6									
70	Statistical value based on			Default to Maximum Value									
71	N			24									
72	% < Detection limit			100%									
73	mean												
74	st. dev.												
75	Z-statistic			1.645									
76	95%UCL on mean			2.2E-01									
77	max value			5.6E-01	U								
78	Statistical value			5.6E-01	U								
79	Background			NA									
80	Statistical value			5.6E-01	U								
82													
83	MTCA 3-PART TEST:												
84	Most Stringent Nonradionuclide Cleanup Limit and RAG Type:			2.1	Human Health Protection								
85	95% UCL > Cleanup Limit?			NO									
86	> 10% above Cleanup Limit?			NO									
87	Any sample > 2X Cleanup Limit?			NO									
88	RISK EVALUATION:												
89	MTCA B Noncarcinogenic Cleanup:			400									
90	Hazard quotient for each nonradionuclide:			NA									
91	MTCA B Carcinogenic Cleanup:			2.1									
92	Risk for each carcinogenic nonradionuclide:			NA									
93	NONRADIONUCLIDE SUMMARY:			*All sample results are below detection.									
94													
95	MTCA Compliance?			YES									
96	Nonrad noncarcinogenic sum of quotients:			NA									
97	Nonrad carcinogenic risk:			NA									

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**Attachment B**

*100-D-12 Pump Station Sample Variance,  
0100D-CA-V0110, Rev. 0*

## CALCULATION COVER SHEET

**Project Title:** 100-DR-1 Remedial Action **Job No.** 22192  
**Area** 100-D  
**Discipline** Environmental **\*Calc. No.** 0100D-CA-V0110  
**Subject** 100-D-12 Pump Station Sample Variance  
**Computer Program** Excel **Program No.** Excel 97

Committed Calculation

Preliminary

Superseded

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 Calculation - 5 Total - 6	C. Trice 6-20-00	JA Cargill 6-20-00 JA Cargill	M. H. Sturges 6-23-00	FM Corpuz FM Corpuz	6-23-00
<b>SUMMARY OF REVISIONS</b>						
<b>Scanned</b>			<b>Rev.</b>	<b>Date</b>	<b>Bar Code No.</b>	

\* Obtain Calc. No. from DIS.

## Calc. Summary

## CALCULATION SHEET

Originator C Trice *CT* Date June 8, 2000 Calc. No. 0100D-CA-V0110 Rev. No. 0  
 Project 100-DR-1 Remedial Action Job No. 22192 Checked SA Cowgill Date 6-30-00  
 Subject 100-D-12 Pump Station Sample Variance Sheet No. 1 of 5

**Problem:**

Perform a sample variance calculation to determine the number of samples required for the 100-D-12 Pump Station, Shallow Zone Decision Unit, verification sampling, as required in DOE/RL-96-22, Rev. 1, "100 AREA REMEDIAL ACTION SAMPLING AND ANALYSIS PLAN" (SAP); and Instruction Guide (IG) 0100X-IG-G0001, Rev. 2, "INSTRUCTION GUIDE FOR THE REMEDIATION OF THE 100 AREAS WASTE SITES."

**Given:**

- 1) Sample locations for the 100-D-12 Pump Station, Shallow Zone Decision Unit, are identified on the 100-D-12 Pump Station, Sample Design, Calculation Number 0100D-CA-V0109, Rev. 0.
- 2) Results of Hexavalent Chromium (Chromium VI) provided by Recra LabNet Laboratory.
- 3) Lookup values from DOE/RL-96-22, Rev 1.
- 4) Requirements from DOE/RL-96-22, Rev 1 and 0100X-IG-G0001, Rev 2.

**Solution:**

Calculation methodology is described in Attachment A-1 of DOE/RL-96-22, Rev 1. Data from attached worksheets are used to calculate the required number of samples. Cr (VI) is the only COC for this site. This metal was present in the original field characterization of the 100-D-12 Pump Station. The basic premise of the statistical design is that this metal species is representative of the contaminant distribution.

Sheet No.	Sheet Title	Topic
1	Calc. Summary	Summary overview of calculation brief.
2	Variance	Variance calculation to compute the number of verification samples required.
3	Formulas	Excel spreadsheet formulas used to perform the variance calculation.
4	Data Summary	Sample ID, sample location, and data for selected analytes.
5	Sample Results	Chromium VI results reported by RECRA laboratory.

Calculation sheets and data sheets are inter-linked in such a way that a change in the data will affect the calculation. An "IF" statement is used in column "O" of the "Data Summary" spreadsheet to verify that the sample identification number and sample location are correctly linked to the appropriate analytical result.

**Conclusion:**

The required number of samples for the 100-D-12 Pump Station, Shallow Zone Decision Sub-Unit, is less than the default number (4 samples) specified in DOE/RL-96-22, Rev 1. Therefore, the default number of four composite samples will be collected from each shallow zone decision sub-unit.

## CALCULATION SHEET

Originator C Trice *CT*  
 Project 100-DR-1 Remedial Action  
 Subject 100-D-12 Pump Station Sample Variance

June 8, 2000

22192

Calc. No. 0100D-CA-V0110 Rev. No. 0

Checked *JA Cowgill* Date *6-20-00*

Sheet No. 2 of 5

## 1 Statistical Evaluation of Analytical Data

2 The required number of samples resulting from the calculation is highlighted at the bottom of the page.

3 Each value is reflective of the specific analyte evaluated.

4 The highest value of the three evaluations is used to determine the required number samples as compared against the default of four.

5

6 Decision Unit = Shallow Zone

Sample Area = "A"

7 Samples values from Chromium VI Analysis in mg/kg.

		Constituent			
8	9	10	11	12	13
Sample #	Location	Cr 6+			
10	Lookup Value=>	2.20E-01			
11	B0Y2L3 A1-2	4.20E-01	U		
12	B0Y2L4 A1-3	4.20E-01	U		
13	B0Y2L5 A1-4	4.20E-01	U		
14	B0Y2L6 A1-10	4.20E-01	U		
15	B0Y2L7 A1-13	4.10E-01	U		
16	B0Y2L8 A1-16	4.40E-01	U		
17	B0Y2L9 A2-3	4.20E-01	U		
18	B0Y2M0 A2-6	4.20E-01	U		
19	B0Y2M1 A2-7	4.20E-01	U		
20	B0Y2M2 A2-10	4.20E-01	U		
21	B0Y2M3 A2-14	4.10E-01	U		
22	B0Y2M4 A2-15	4.30E-01	U		
23	B0Y2M5 A3-1	4.20E-01	U		
24	B0Y2M6 A3-2	4.20E-01	U		
25	B0Y2M7 A3-4	4.00E-01	U		
26	B0Y2M8 A3-5	4.10E-01	U		
27	B0Y2M9 A3-9	4.10E-01	U		
28	B0Y2N0 A3-11	4.20E-01	U		
29	B0Y2N1 A4-3	5.60E-01	U		
30	B0Y2N2 A4-4	4.20E-01	U		
31	B0Y2N3 A4-7	4.30E-01	U		
32	B0Y2N4 A4-9	4.10E-01	U		
33	B0Y2N5 A4-12	4.10E-01	U		
34	B0Y2N6 A4-13	4.20E-01	U		
35	Mean=>	4.24E-01			
36	Standard Deviation=>	3.01E-02			
37	$\tau$ =>	5.91E+01			
38	Number of Samples>	1.77E-03			

## Formulas

A	B	C	D	E	F	G	H	I	J	K
1					CALCULATION SHEET					
2	Originator	C. Trice		Date	June 8, 2020	Calc. No.	01000-CA-10110			Rev. No. 0
3	Project	100-LP-1 Remedial Action		Job No.	22192	Checked	JA/ajm			Date 6-18-20
	Subplot	100-L-12 Pump Station Sample Variance								Sheet No. 3 of 5
7	Statistical Evaluation of Analytical Data									
8	The required number of samples resulting from this calculation is highlighted at the bottom of the page.									
9	Each value is reflective of the specific analysis evaluated.									
10	The highest value of the three evaluations is used to determine the required number samples as compared against the default of five.									
11				Sample Area = "A"						
12	Decision Unit = Shadow Zone									
13	Sample Values From Chromium 6+ In Right				Constituent					
14										
15	Sample #	Location	Cr 6+							
16										
17	"Date Summary/87	"Date Summary/07	"Date Summary/17	"Date Summary/17						
18	"Date Summary/88	"Date Summary/08	"Date Summary/18	"Date Summary/18						
19	"Date Summary/89	"Date Summary/09	"Date Summary/19	"Date Summary/19						
20	"Date Summary/90	"Date Summary/10	"Date Summary/20	"Date Summary/20						
21	"Date Summary/91	"Date Summary/11	"Date Summary/21	"Date Summary/21						
22	"Date Summary/92	"Date Summary/12	"Date Summary/22	"Date Summary/22						
23	"Date Summary/93	"Date Summary/13	"Date Summary/23	"Date Summary/23						
24	"Date Summary/94	"Date Summary/14	"Date Summary/24	"Date Summary/24						
25	"Date Summary/95	"Date Summary/15	"Date Summary/25	"Date Summary/25						
26	"Date Summary/96	"Date Summary/16	"Date Summary/26	"Date Summary/26						
27	"Date Summary/97	"Date Summary/17	"Date Summary/27	"Date Summary/27						
28	"Date Summary/98	"Date Summary/18	"Date Summary/28	"Date Summary/28						
29	"Date Summary/99	"Date Summary/19	"Date Summary/29	"Date Summary/29						
30	"Date Summary/00	"Date Summary/20	"Date Summary/30	"Date Summary/30						
31	"Date Summary/01	"Date Summary/21	"Date Summary/31	"Date Summary/31						
32	"Date Summary/02	"Date Summary/22	"Date Summary/32	"Date Summary/32						
33	"Date Summary/03	"Date Summary/23	"Date Summary/33	"Date Summary/33						
34	"Date Summary/04	"Date Summary/24	"Date Summary/34	"Date Summary/34						
35	"Date Summary/05	"Date Summary/25	"Date Summary/35	"Date Summary/35						
36	"Date Summary/06	"Date Summary/26	"Date Summary/36	"Date Summary/36						
37	"Date Summary/07	"Date Summary/27	"Date Summary/37	"Date Summary/37						
38	"Date Summary/08	"Date Summary/28	"Date Summary/38	"Date Summary/38						
39	"Date Summary/09	"Date Summary/29	"Date Summary/39	"Date Summary/39						
40	"Date Summary/10	"Date Summary/30	"Date Summary/40	"Date Summary/40						
41	Mean	=AVERAGE(D1:D40)								
42	Standard Deviation	=STDEV(D1:D40)								
43	1	=D16-D11/D42								
44	Number of Samples	=ROUNDUP(D43*2043^2)								

## CALCULATION SHEET

1  
 2 Originator C Trice OK Date June 8, 2000 Calc. No. 0100D-CA-V0110  
 3 Project 100-DR-1 Remedial Action Job No. 22182 Checked JA Corbin  
 4 Subject 100-D-12 Pump Station Sample Variance

Rev. No. 0  
 Date 6-20-00  
 Sheet No. 4 of 5

5 Decision Unit = Shallow Zone

Sampling Areas = "A"

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	B0Y2L3	5/1/2000 10:00 AM	A1-2	Shallow Zone	151407.29	573345.52	B0Y2L3	0.42	U															
	B0Y2L4	5/1/2000 10:03 AM	A1-3	Shallow Zone	151406.02	573345.39	B0Y2L4	0.42	U															
	B0Y2L5	5/1/2000 10:06 AM	A1-4	Shallow Zone	151404.85	573345.41	B0Y2L5	0.42	U															
	B0Y2L6	5/1/2000 10:09 AM	A1-10	Shallow Zone	151408.67	573347.62	B0Y2L6	0.42	U															
	B0Y2L7	5/1/2000 10:12 AM	A1-13	Shallow Zone	151403.19	573347.73	B0Y2L7	0.41	U															
	B0Y2L8	5/1/2000 10:15 AM	A1-16	Shallow Zone	151397.56	573347.85	B0Y2L8	0.44	U															
	B0Y2L9	5/1/2000 10:18 AM	A2-3	Shallow Zone	151407.58	573349.31	B0Y2L9	0.42	U															
	B0Y2M0	5/1/2000 10:21 AM	A2-6	Shallow Zone	151401.55	573349.39	B0Y2M0	0.42	U															
	B0Y2M1	5/1/2000 10:24 AM	A2-7	Shallow Zone	151399.44	573349.41	B0Y2M1	0.42	U															
	B0Y2M2	5/1/2000 10:27 AM	A2-10	Shallow Zone	151409.32	573350.86	B0Y2M2	0.42	U															
	B0Y2M3	5/1/2000 10:30 AM	A2-14	Shallow Zone	151401.00	573350.96	B0Y2M3	0.41	U															
	B0Y2M4	5/1/2000 10:33 AM	A2-15	Shallow Zone	151399.04	573350.99	B0Y2M4	0.43	U															
	B0Y2M5	5/1/2000 10:36 AM	A3-1	Shallow Zone	151411.58	573352.28	B0Y2M5	0.42	U															
	B0Y2M6	5/1/2000 10:39 AM	A3-2	Shallow Zone	151409.49	573352.33	B0Y2M6	0.42	U															
	B0Y2M7	5/1/2000 10:42 AM	A3-4	Shallow Zone	151405.37	573352.43	B0Y2M7	0.40	U															
	B0Y2M8	5/1/2000 10:45 AM	A3-5	Shallow Zone	151403.32	573352.48	B0Y2M8	0.41	U															
	B0Y2M9	5/1/2000 10:48 AM	A3-9	Shallow Zone	151411.54	573353.83	B0Y2M9	0.41	U															
	B0Y2N0	5/1/2000 10:51 AM	A3-11	Shallow Zone	151407.52	573353.93	B0Y2N0	0.42	U															
	B0Y2N1	5/1/2000 10:54 AM	A4-3	Shallow Zone	151408.66	573355.61	B0Y2N1	0.66	U															
	B0Y2N2	5/1/2000 10:57 AM	A4-4	Shallow Zone	151404.82	573355.65	B0Y2N2	0.42	U															
	B0Y2N3	5/1/2000 11:00 AM	A4-7	Shallow Zone	151399.26	573355.76	B0Y2N3	0.43	U															
	B0Y2N4	5/1/2000 11:03 AM	A4-9	Shallow Zone	151408.61	573357.10	B0Y2N4	0.41	U															
	B0Y2N5	5/1/2000 11:06 AM	A4-12	Shallow Zone	151404.00	573357.73	B0Y2N5	0.41	U															
	B0Y2N6	5/1/2000 11:09 AM	A4-13	Shallow Zone	151402.67	573357.74	B0Y2N6	0.42	U															

## Sample Results

## ANALYSIS SHEET

1  
2 Originator C. Price  
3 Project 100-DR-1 Remedial Action  
4 Subject 100-D-12 Pump Station Sample Variance  
5 Decision Unit = Shallow Zone

Date June 8, 2000 Calc. No. 0100D-CA-V0110  
Job No. 22192 Checked JA Cowgill

Rev. No. 0  
Date 6-20-00  
Sheet No. 5 of 5

Sampling Area = "A"

Sample	Time	Location	Conc.	Unit
B0Y2L3	2/4/2000 10:02 AM	A1-2	0.42	U
B0Y2L4	2/4/2000 10:00 AM	A1-3	0.42	U
B0Y2L6	2/4/2000 10:04 AM	A1-4	0.42	U
B0Y2L6	2/4/2000 10:05 AM	A1-10	0.42	U
B0Y2L7	2/4/2000 10:07 AM	A1-13	0.41	U
B0Y2L8	2/4/2000 10:09 AM	A1-16	0.44	U
B0Y2L9	2/4/2000 10:11 AM	A2-3	0.42	U
B0Y2M0	2/4/2000 10:14 AM	A2-6	0.42	U
B0Y2M1	2/4/2000 10:16 AM	A2-7	0.42	U
B0Y2M2	2/4/2000 10:19 AM	A2-10	0.42	U
B0Y2M3	2/4/2000 10:20 AM	A2-14	0.41	U
B0Y2M4	2/4/2000 10:21 AM	A2-15	0.43	U
B0Y2M5	2/4/2000 10:23 AM	A3-1	0.42	U
B0Y2M6	2/4/2000 10:25 AM	A3-2	0.42	U
B0Y2M7	2/4/2000 10:27 AM	A3-4	0.40	U
B0Y2M8	2/4/2000 10:29 AM	A3-5	0.41	U
B0Y2M9	2/4/2000 10:31 AM	A3-9	0.41	U
B0Y2N0	2/4/2000 10:34 AM	A3-11	0.42	U
B0Y2N1	2/4/2000 10:36 AM	A4-3	0.56	U
B0Y2N2	2/4/2000 10:39 AM	A4-4	0.42	U
B0Y2N3	2/4/2000 10:41 AM	A4-7	0.43	U
B0Y2N4	2/4/2000 10:43 AM	A4-9	0.41	U
B0Y2N5	2/4/2000 10:46 AM	A4-12	0.41	U
B0Y2N6	2/4/2000 10:49 AM	A4-13	0.42	U



Attachment C

*100-D-12 Shallow Zone Sample Location Design,  
0100D-CA-V0109, Rev. 0*



ATTACHMENT 1

Table A-1. Sample Grid Point Lookup Table.

Default Plan	Sampling Area 1	Sampling Area 2	Sampling Area 3	Sampling Area 4	Sampling Area 5	Sampling Area 6	Sampling Area 7	Sampling Area 8	Sampling Area 9	Sampling Area 10
HPGe/Closeout	3	6	1	4	5	1	3	3	4	16
HPGe/Closeout	4	7	11	3	15	15	5	13	10	10
HPGe/Closeout	16	3	2	7	7	10	11	4	3	14
HPGe/Closeout	10	15	4	12	1	13	4	8	16	4
HPGe	2	14	5	9	13	12	8	2	14	8
HPGe	13	10	9	13	2	16	1	12	5	3
Not sampling	6	1	10	8	14	4	16	5	8	6
Not sampling	1	9	13	1	10	5	12	1	1	15
Not sampling	9	12	7	5	6	2	6	7	15	9
Not sampling	15	16	15	14	16	6	2	15	11	1
Not sampling	8	13	8	10	12	11	13	14	2	12
Not sampling	5	2	3	11	4	3	9	10	7	11
Not sampling	7	11	14	15	11	14	14	6	13	2
Not sampling	11	4	6	2	9	7	7	11	9	7
Not sampling	12	8	16	16	3	8	15	9	6	13
Not sampling	14	5	12	6	8	9	10	16	12	5

**\*\*NOTE:** Grid nodes for each sampling area in each waste site should be numbered consistently, e.g., begin numbering the nodes in the northwesternmost node. Then number consecutively left to right as shown in Figure 5-1 of this IG.

Attachment 1  
 Originator G.C.C.U.  
 Ckd By JB KERRON REL  
 Calc. No. 01000-04-V01004  
 Sheet No. 1 of 1  
 Date 7-25-00  
 Date 4-26-00  
 Rev. No. 0

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[illegible]

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## ATTACHMENT 2

Table 5-1. Number of Decision Subunits Based on Area.

Area of Primary Decision Unit (m <sup>2</sup> )	Number of Subunits
<1,394	1
>1,394 to <2,323	2
>2,323 to <3,252	3
>3,252 to <4,181	4
>4,181 to <9,290	2
>9,290 to <13,006	3
>13,006 to <16,723	4
>16,723 to <20,439	5
>20,439	ROUND <sup>a</sup> (Area/3,716)

<sup>a</sup> ROUND is an integer rounding function.

Attachment 2 Sheet No. 1 of 1  
 Originator G. CRUZ Date 4-25-00  
 Chk'd By RR KERLOW RRK Date 4-26-00  
 Calc. No. 01000-CA-V0109 Rev. No. 0

**Distribution**

084033

**Unit Managers' Meeting: 100 Area Remedial Action Unit/Source Operable Units**

Glenn Goldberg ..... DOE-RL, RP (H0-12)  
Owen Robertson..... DOE-RL, RP (H0-12)  
Chris Smith ..... DOE-RL, RP (H0-12)  
Eileen Murphy-Fitch ..... DOE-RL (H0-12)

Lisa Treichel ..... DOE-HQ (EM-442)

Wayne Soper..... WDOE (Kennewick) (B5-18)  
John Price..... WDOE (Kennewick) (B5-18)

Dennis Faulk..... EPA (B5-01)

Debora McBaugh..... Washington Dept. of Health  
Richard Jaquish..... Washington Dept. of Health

John April..... BHI (H0-17)  
Ella Coenenburg..... BHI (H9-03)  
Frank Corpuz..... BHI (X9-06)  
Rick Donahoe..... BHI (X5-60)  
Jon Fancher..... CHI (X5-60)  
Chris Kemp..... BHI (S3-20)  
Tom Kisenwether..... BHI (X9-10)  
Alvin Langstaff..... BHI (X9-06)  
Tamen Rodriguez..... BHI (H0-17)  
Fred Roeck..... BHI (H0-17)  
Mark Sturges..... CHI (X9-06)  
Joan Woolard ..... BHI (H0-02)  
Administrative Record ..... BHI (H0-09) 2 copies

Please inform Tamen Rodriguez (372-9562) – BHI (H0-17)  
of deletions or additions to the distribution list.